

Fluctuation adjustment between the image pickup elements in an image pickup apparatus is two-dimensionally performed using ratios  $R/B$  and  $(R+B)/(G1+G2)$  of reference data  $R_{refa}$ ,  $G1_{refa}$ ,  $G2_{refa}$ ,  $B_{refa}$  of a light source a, reference data  $R_{refb}$ ,  $G1_{refb}$ ,  $G2_{refb}$ , and  $B_{refb}$  of a light source b, and data  $R_a$ ,  $G1_a$ ,  $G2_a$ , and  $B_a$  of the light source a, and data  $R_bS$ ,  $G1_bS$ ,  $G2_bS$  and  $B_bS$  of the light source b which are unique to the image pickup apparatus.

The method of fluctuation adjustment calculation between the image pickup elements in an image pickup apparatus can be expressed by a difference such as an  $(R-B)$  value or  $(R+B) - (G1+G2)$  value. Any mathematical expression can be used if it can be expressed so as to absorb fluctuations between the image pickup elements in the image pickup apparatus.

First of all, the relationship between the reference data  $R_{refaS}$ ,  $G1_{refaS}$ ,  $G2_{refaS}$ ,  $B_{refaS}$ ,  $R_{refbS}$ ,  $G1_{refbS}$ ,  $G2_{refbS}$ , and  $B_{refbS}$  (1203) read out from a given recording medium and adjustment data  $R_aS$ ,  $G1_aS$ ,  $G2_aS$ ,  $B_aS$ ,  $R_bS$ ,  $G1_bS$ ,  $G2_bS$ , and  $B_bS$  (1204) unique to the image pickup apparatus and recorded on the given recording medium is adjusted using MWB and color balance gain adjustment data  $R$ ,  $G1$ ,  $G2$ , and  $B$  read out from the given recording medium.

Gain values and offset values of the difference between the  $R/B$  ratios and  $(R+B)/(G1+G2)$  ratios of the

light sources a and b are obtained:

$$\begin{aligned} \text{GainRB} = & \{ (\text{RrefaS}/\text{BrefaS}) \\ & - (\text{RrefbS}/\text{BrefbS}) \} / \{ (\text{RaS}/\text{BaS}) \\ & - (\text{RbS}/\text{BbS}) \} \end{aligned} \quad \dots(1)$$

$$\begin{aligned} 5 \quad \text{OffsetRB} = & (\text{RrefaS}/\text{BrefaS}) - \text{GainRB} * (\text{RaS}/\text{BaS}) \\ & \dots(2) \end{aligned}$$

These are reflected on the gain adjustment data.

$$(\text{R}'/\text{B}') = \text{GainRB} * (\text{R}/\text{B}) + \text{OffsetRB} \quad \dots(3)$$

Similarly, the following relations are obtained for the

10  $(\text{R}+\text{B})/(\text{G1}+\text{G2})$  ratios:

$$\begin{aligned} \text{GainRBG1G2} = & \{ (\text{RrefaS}+\text{BrefaS})/(\text{G1refaS}+\text{G2refaS}) \\ & - (\text{RrefbS}+\text{BrefbS})/(\text{G1refbS}+\text{G2refbS}) \} / \\ & \{ (\text{RaS}+\text{BaS})/(\text{G1aS}+\text{G2aS}) - (\text{RbS}+\text{BbS})/ \\ & (\text{G1bS}+\text{G2bS}) \} \end{aligned} \quad \dots(4)$$

$$\begin{aligned} 15 \quad \text{OffsetRBG1G2} = & \{ (\text{RrefaS}+\text{BrefaS})/(\text{G1refaS}+\text{G2refaS}) \} \\ & - \text{GainRBG1G2} * \{ (\text{RaS}+\text{BaS})/(\text{G1aS}+\text{G2aS}) \} \\ & \dots(5) \end{aligned}$$

$$\begin{aligned} (\text{R}'+\text{B}')/(\text{G1}'+\text{G2}') = & \text{GainRBG1G2} * \{ (\text{R}+\text{B})/(\text{G1}+\text{G2}) \} \\ & + \text{OffsetRBG1G2} \end{aligned} \quad \dots(6)$$

20 These equations yield data  $\text{R}'$ ,  $\text{G1}'$ ,  $\text{G2}'$  and  $\text{B}'$  converted into reference data for the image pickup apparatus which recorded the data on the medium. The resultant data is given by adjustment operation (1) 1207 shown in Fig. 10.

25 Now assuming that  $\text{G1}'$  and  $\text{G2}'$  are fixed values respectively such as  $\text{G1}' = \text{G1refbS}$  and  $\text{G2}' = \text{G2refbS}$ ,  $\text{R}'$  and  $\text{B}'$  can be calculated from the equations (3) and

(6) which calculate  $R'/B'$  and  $(R'+B')/(G1'+G2')$  respectively. The thus-obtained  $R'$ ,  $G1'$ ,  $G2'$  and  $B'$  are written by the image filing unit 406 into a file same as the image file as reference white sheet data for MWB. A procedure 1208 is a processing method of transferring the white sheet data for MWB to an other image pickup apparatus D 1202 through the image file thus-recorded on the recording medium.

Next, a method of setting the white sheet data for MWB to the image pickup apparatus D 1202 will be explained. Since the MWB white sheet data  $R'$ ,  $G1'$ ,  $G2'$  and  $B'$  are read out from the recording medium as reference white sheet data for MWB, an operation 2 which adjusts data whose characteristic is suitable for the image pickup apparatus D 1202 is performed using reference data 1205 and specific data 1206 of light sources a and b of the image pickup apparatus D 1202. The adjustment operation is performed to calculate gain value and offset value of difference in a ratio  $R/B$  and a ratio  $(R+B)/(G1+G2)$  between the light source a and the light source b, wherein

$$\begin{aligned} \text{GainRB}' &= \{ (RaD/BaD) - (RbD/BbD) \} / \{ (RrefaD/BrefaD) \\ &\quad - (RrefbD/BrefbD) \} \end{aligned} \quad \dots (7)$$

$$\begin{aligned} \text{OffsetRB}' &= (RaS/BaS) - \text{GainRB}' * (RrefaS/BrefaS) \end{aligned} \quad \dots (8)$$

These results are reflected on gain adjustment data, that is,